Space Weather Technical Forecast

Issued on Tuesday, 23 August 2022 at 01:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active fluence likely persisting throughout. Slight chance of R1 from AR3085.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity is Low, with eight sunspot region on the Earth-facing disc, four of which are numbered. The majority of these are small and simple, with the main region AR3085 Dsi/Beta-gamma in the north centre disc. This has been the source of a number of C-flares, and has shown ongoing steady growth. Despite this, it remains relatively magnetically simple with only small reverse polarity intermediate spots resulting in its beta-gamma magnetic type. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR, persisted elevated levels due to the ongoing fast wind regime. The speed eased slightly from 550-600km/s, to around 520km/s. The density was at or below average. The total magnetic field strength (IMF) Bt, was generally weak, at 5-7nT, with the north-south component variable between -7nT and +5nT. The phi angle was negative (towards the Sun). Geomagnetic activity was generally Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES-16, was at Background levels. The high energy electron flux (greater than 2 MeV) was at Moderate to High levels, with a peak of 3820 pfu at 22/1645 UTC. The 24-hour integrated electron exceeded the Active threshold at 22/0600 UTC, and has continued to rise through the period reaching 1.7e8 integrated pfu at 23/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low, but with a slight chance of increasing to Moderate, with isolated M-flares. AR3085 is the most likely source for this activity.

Solar Wind / Geomagnetic Activity: There is still a slight chance of a glancing impact from a CME early on day 1 (23rd), however this is looking increasingly less likely and the effect of any impact is likely to be minimal. Current elevated solar winds are expected to gradually decline through the period, falling to background through day 3 and 4 (25th and 26th).Geomagnetic activity is forecast to be largely Quiet to Unsettled. There remains a chance of Active, and a slight chance of G1 Minor storm intervals early day 1 (23rd), should any CME arrival occur.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is forecast to remain at Background levels. The high energy electron flux (greater than 2 MeV) is currently at High levels, and in the absence of any CME arrival is expected to persist largely at this level, only gradually declining later in the period. Any CME arrival could result in a drop out in flux, however this is now very low confidence. Consequently the associated 24 hour fluence is expected to remain at Active levels throughout, perhaps with a declining trend later in the period.

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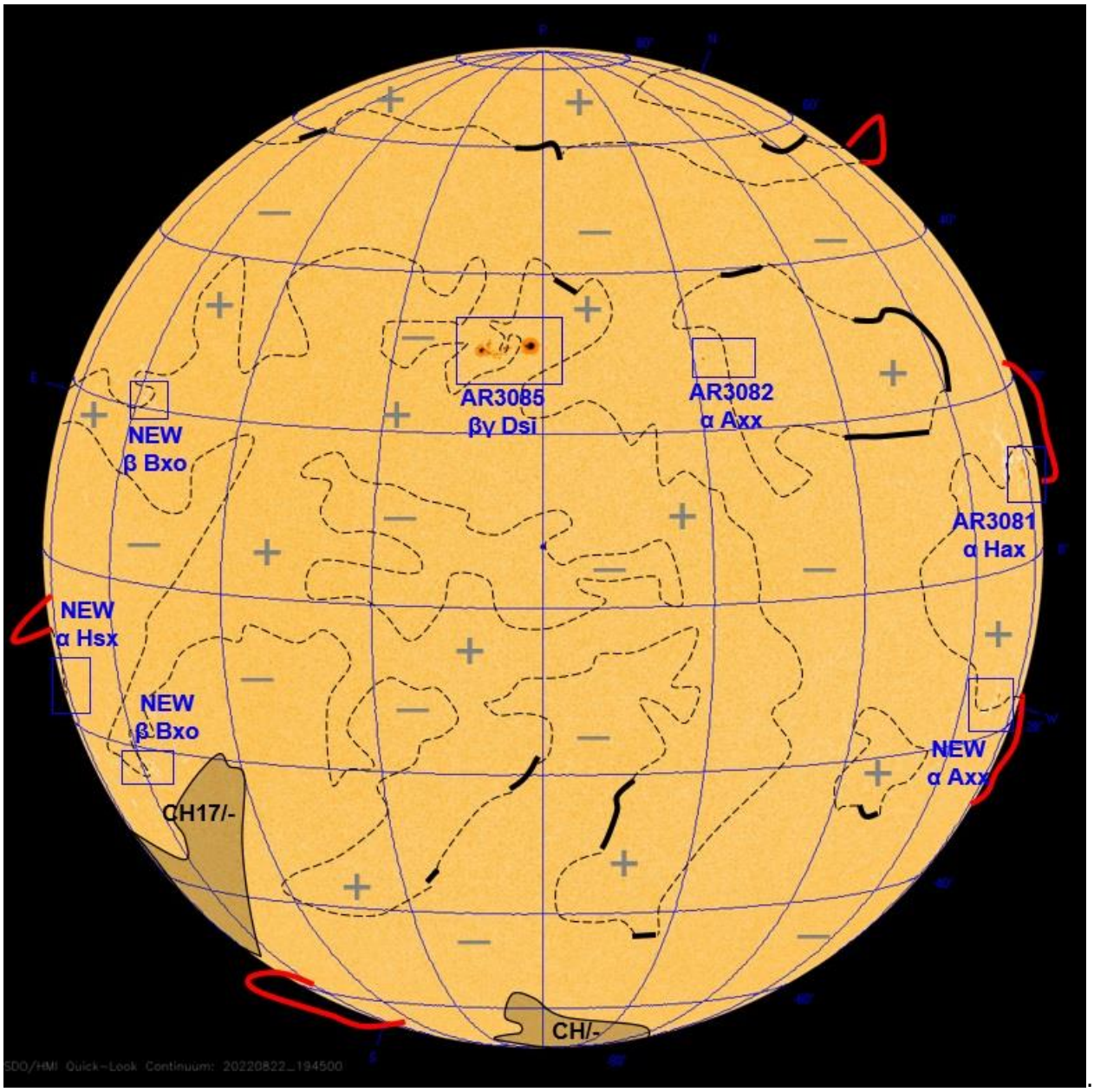
Figure 1. Solar Analysis Valid 22/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds at Earth have been elevated due to ongoing coronal hole effects. There is still the outside chance of a glancing impact from the last of the CMEs from AR3078 early on day 1 (23rd). This left the Sun on the 19th, due to a long period M1.6 flare with a slight chance of arrival at 21/1800 UTC +/- 12 hours. There are no other Earth-directed CMEs.

Solar winds are expected to gradually ease through the period, as current fast wind influences recede. However MOSWOC enlil currently indicates a solar wind enhancement late on day 1 or day 2 (23rd and 24th). This is now considered to be a likely over-estimation of potential solar winds based upon a broad area of weak fields that is currently present in the centre disc. Solar winds are considered more likely to follow closer to 27-day persistence, easing towards background days 3 to 4 (25-26th)

Geomagnetic activity is forecast to be largely Quiet to Unsettled. There remains a chance of Active, and a slight chance of G1 Minor storm intervals early day 1 (23rd), should any CME arrival manifest.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/1131 UTC	Partial	AR3078 M1.6 flare	SW	700	22/1800 +/- 12 hours	Glancing impact. Likely missed, but slight chance of arrival still

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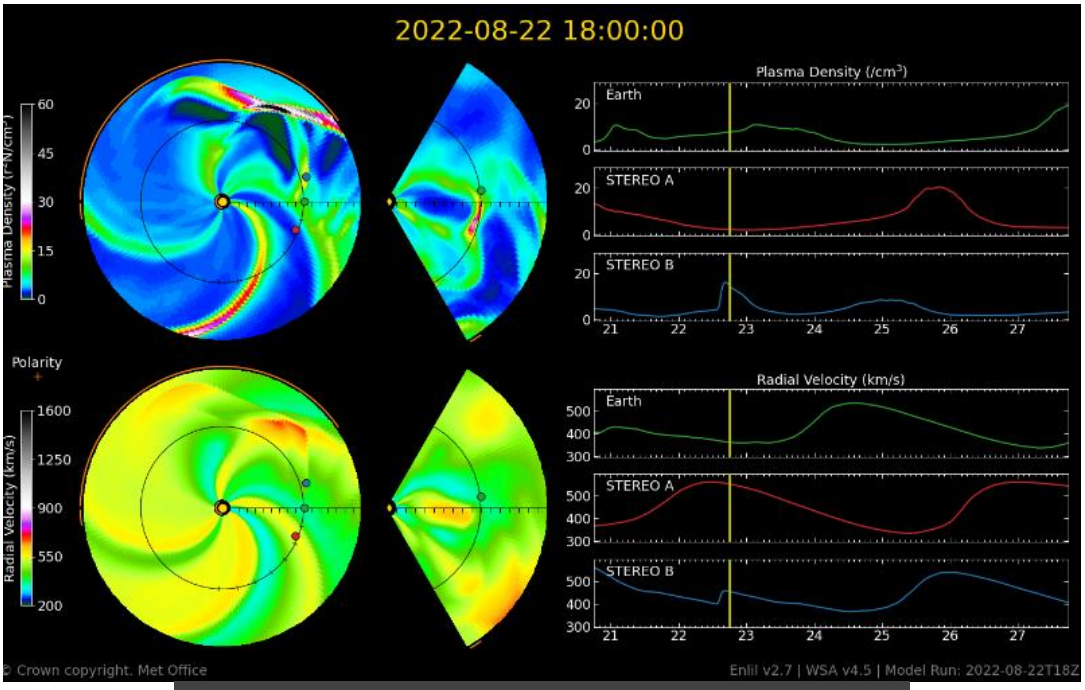
Figure 2: Enlil and Ensemble. Enhancement on 23rd considered over-estimated and likely erroneous. Background winds before then look too low considering current observations at L1 – perhaps the cause of glancing CME missing, rather than being a hit.



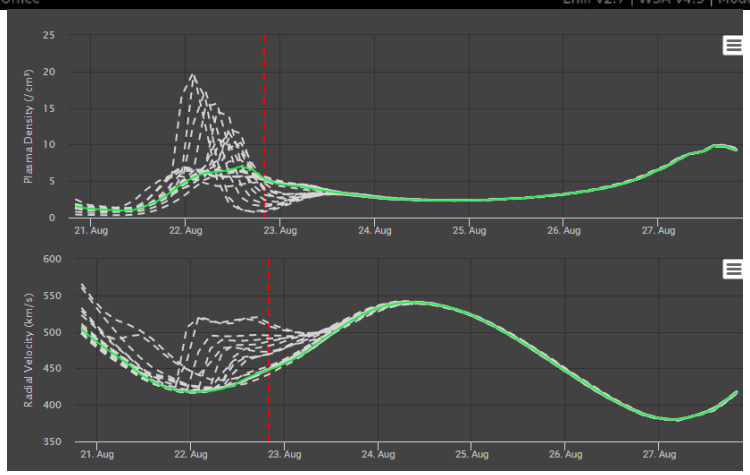
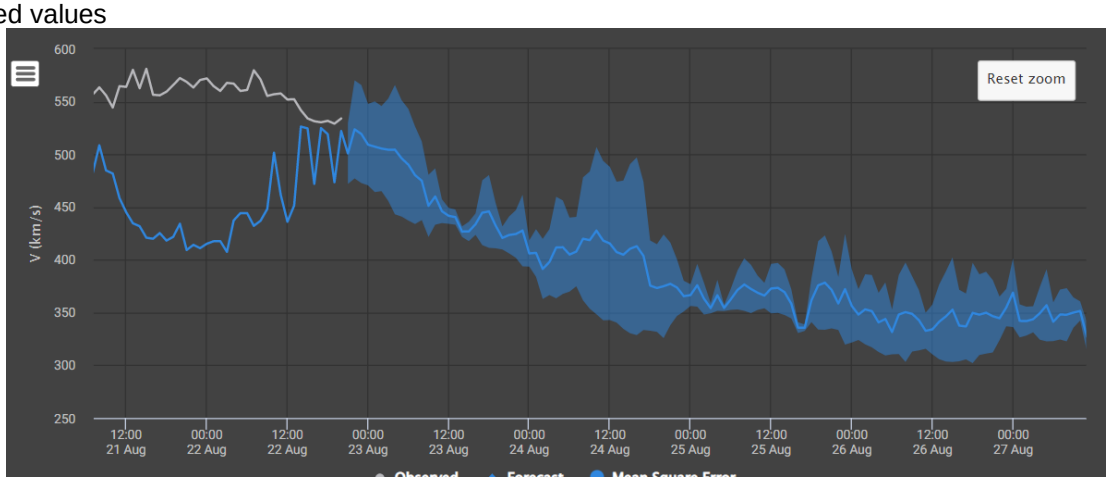


Figure 3: Solar Wind Persistence Model (Observed: white, Model: Blue) This is expected to be closer to observed values



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Radio Blackouts - X-Ray Flares:

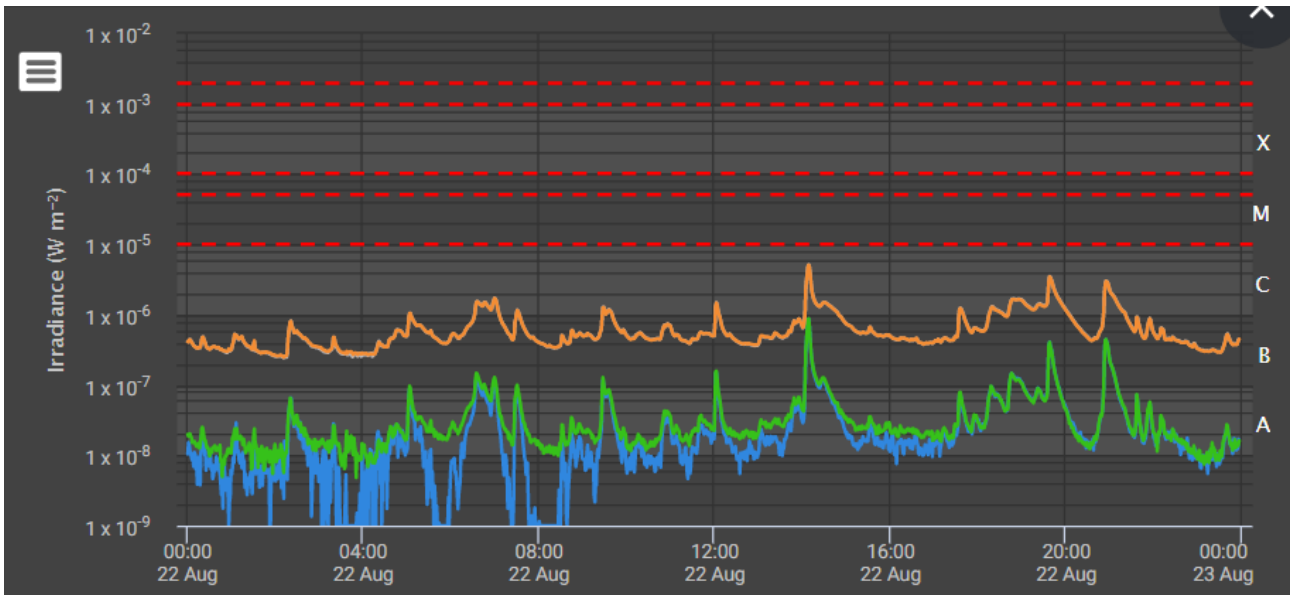
Solar activity is currently Low with frequent C-flares from AR3085 Dsi/Beta-gamma. This region has exhibited slow growth in the last 48 hours, but remains modestly sized with only limited shear across its field lines due to its east-west orientation. Reverse polarity intermediate spots (compared to the main trailer and leader) do suggest some level of magnetic complexity, however without further growth this region only gives a slight chance of M-flares.

There are a number of other regions on the visible disc, including three other numbered spots, but these are all weak and largely fading. Four further unnumbered spots have been identified, including a small region in the southwest, two small areas of emergent flux in the southeast and northeast, and another probably mature monopolar region in the southeast. Although this latter region will need to rotate into a clearer field of view in order to fully assess.

Low activity is expected to continue due to AR3085, with a slight chance of increasing to Moderate due to any M-flares that may occur.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 4: GOES-16/17 X-ray flux



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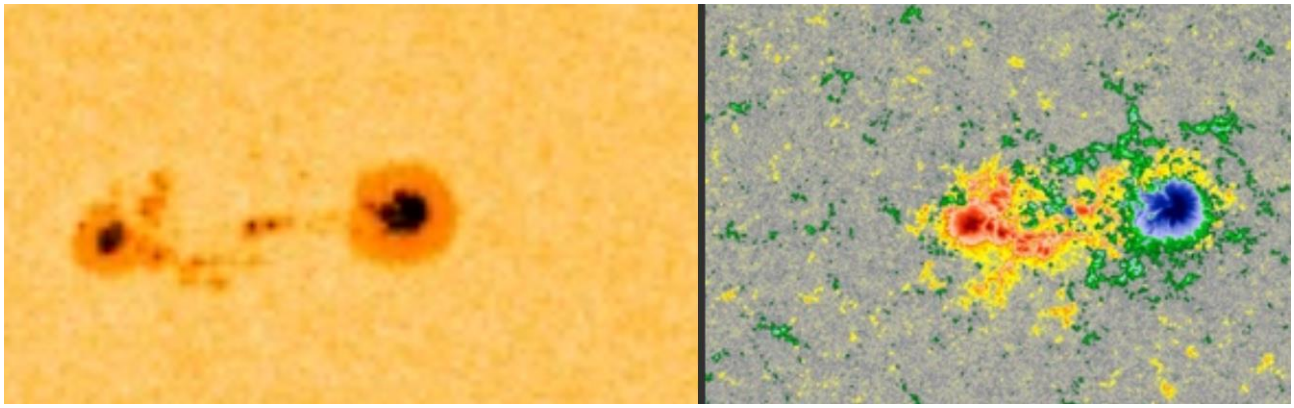
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 is at background, and is expected to remain at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 5: AR3085 at 22/2100 in SDO hmi-intensitygram and SDO hmi-magnetogram.



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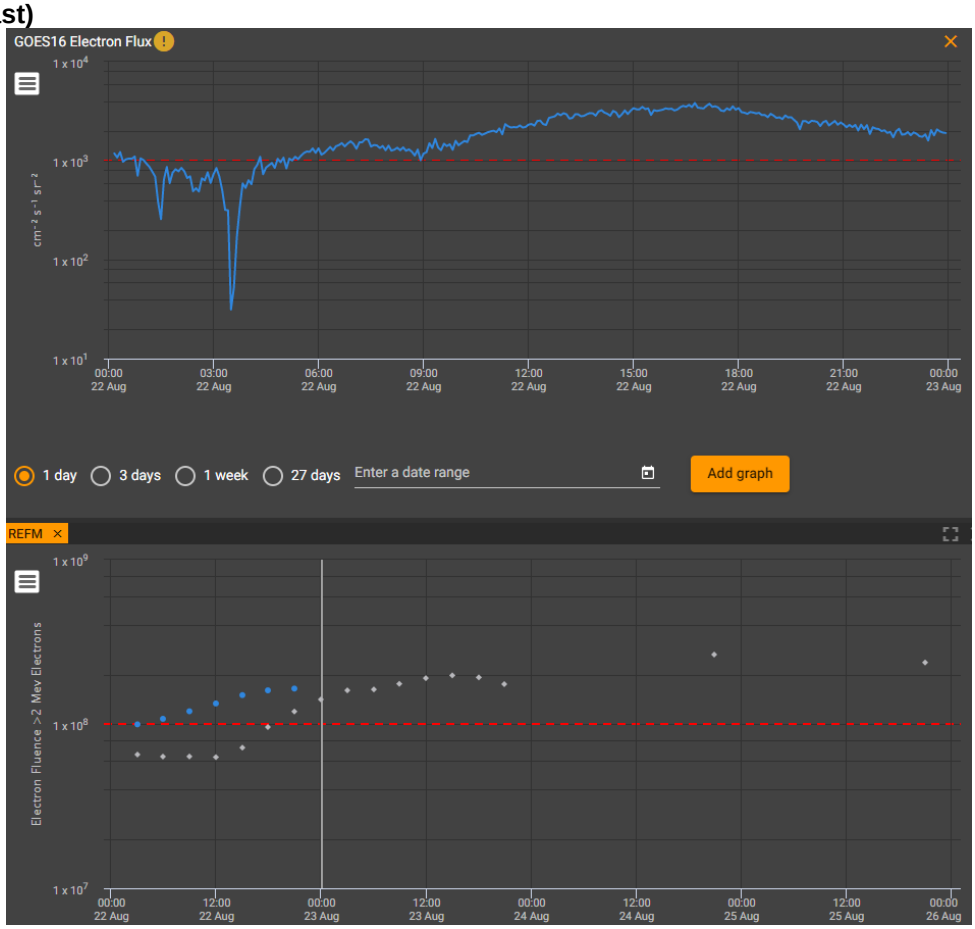
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as measured by GOES-16 is currently high after recent coronal hole and CME enhancements to the solar wind environment. Any potential drop out of flux is dependent upon the arrival of a CME early on the 23rd, however this is now looking less likely. Furthermore, if it does occur, this will have lower potential impact the latter it does. Due to this generally high flux expected to either persist day 1 or potentially return after any such CME impact. Only a gradual reduction in peak values is then likely

The associated fluence is expected to remain Active throughout, as supported by REFM. This is likely giving good guidance, unless the CME arrival occurs.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	80	70	70
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 6: GOES-16 Electron Flux (last 24 hours) and associated fluence with REFM (last 24 hrs, plus 3 day forecast)



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